

BU 98P 1671

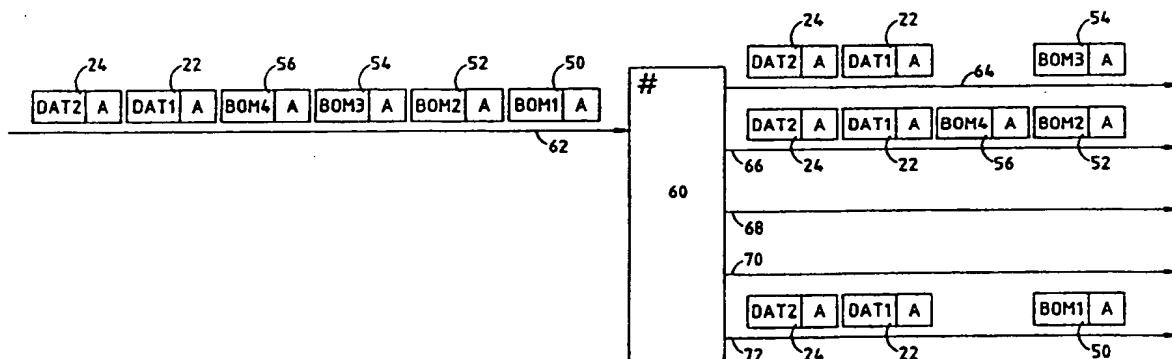
PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 :	A1	(11) International Publication Number:	WO 91/15070
H04L 12/56, 12/18		(43) International Publication Date:	3 October 1991 (03.10.91)
(21) International Application Number:	PCT/AU91/00111		
(22) International Filing Date:	22 March 1991 (22.03.91)		
(30) Priority data:	PJ 9227	22 March 1990 (22.03.90)	AU
(71) Applicant (for all designated States except US):	AUSTRALIAN TELECOMMUNICATIONS CORPORATION [AU/AU]; 199 William Street, Melbourne, VIC 3000 (AU).		
(72) Inventor; and			
(75) Inventor/Applicant (for US only) :	LITTLEWOOD, Morgan [AU/AU]; 1/31 Broadway, Elwood, VIC 3184 (AU).		
(74) Agents:	WEBBER, David, Brian et al.; Davies & Collison, 1 Little Collins Street, Melbourne, VIC 3000 (AU).		
(81) Designated States:	AT (European patent), AU, BE (European patent), CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent), US.		
Published	With international search report.		

(54) Title: MULTICASTING METHOD FOR A TELECOMMUNICATIONS NETWORK



(57) Abstract

A multicasting method for a telecommunications network which is adapted to transmit information in segments (20, 22, 24) of data (10). The method involves generating and transmitting segments (22, 24) of data (10) to be multicast with the segments including common message identification data (32) and routing the segments (22, 24) through the network using at least one switching station (60) which outputs the segments (22, 24) to a plurality of output ports (64, 66, 62, 72) of the station (60) on the basis of the message identification data (32). Beginning segments (50, 52, 54, 56) are generated which have respective destination addresses, the message identification data (32) and the common part of the information to be transmitted. The beginning segments (50, 52, 54, 56) are transmitted through the network on the basis of the destination addresses to the destinations corresponding thereto and routes are established through the network to the destinations on the basis of the message identification data (32). The remainder of the information is transmitted on at least one remainder segment (22, 24) which includes the message identification data (32). The remainder segments (22, 24) are routed through the network to the destinations on the basis of the message identification data (32). A switching station (60) is provided which is adapted to process the beginning segments (50, 52, 54, 56) as they are routed through the network and establish routing data for storage therein, which is used to direct the remainder segments (22, 24) to output ports (64, 66, 72) of the station (60) on the basis of the message identification data.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	ES	Spain	MG	Madagascar
AU	Australia	FI	Finland	ML	Mali
BB	Barbados	FR	France	MN	Mongolia
BE	Belgium	GA	Gabon	MR	Mauritania
BF	Burkina Faso	GB	United Kingdom	MW	Malawi
BG	Bulgaria	GN	Guinea	NL	Netherlands
BJ	Benin	GR	Greece	NO	Norway
BR	Brazil	HU	Hungary	PL	Poland
CA	Canada	IT	Italy	RO	Romania
CF	Central African Republic	JP	Japan	SD	Sudan
CG	Congo	KP	Democratic People's Republic of Korea	SE	Sweden
CH	Switzerland	KR	Republic of Korea	SN	Senegal
CI	Côte d'Ivoire	LI	Liechtenstein	SU	Soviet Union
CM	Cameroon	LK	Sri Lanka	TD	Chad
CS	Czechoslovakia	LU	Luxembourg	TG	Togo
DE	Germany	MC	Monaco	US	United States of America

- 1 -

MULTICASTING METHOD FOR A TELECOMMUNICATIONS NETWORK

The present invention relates to a multicasting method for a
5 telecommunications network which is adapted to transmit information in segments of
data.

Multicasting is the process of distributing information from a single source to
a number of destinations over a telecommunications network. There is a desire for
10 multicasting capabilities to be provided on Metropolitan Area Networks (MAN) and
on the broadband ISDN. Multicasting on networks can be used for electric
publication, software distribution and Local Area Network bridging.

At present broadcasting and replication are two methods which are used to
15 achieve multicasting. Broadcasting involves assigning a group address to all of the
intended destinations. The information to be transmitted is then broadcast to all
stations on all sub-networks of the network and the intended destinations selectively
receive the broadcast information on the basis of the group address transmitted with
the information. If only a small subset of stations are intended to receive the
20 broadcast, then this method represents a significant wastage of the transmission
resources of the network.

Replication involves replicating or copying packets at the source of the
information and transmitting each packet, in a normal manner to a respective one of
25 the intended destinations. Although this method is relatively simple to manage, it is
inefficient in its use of transmission resources, particularly when the number of
intended destinations is large.

In accordance with the present invention there is provided a multicasting
30 method for a telecommunications network which is adapted to transmit information
in segments of data, said method comprising:

- 2 -

generating and transmitting segments of data to be multicast, said segments including common message identification data;

routing said segments through said network using at least one switching station which outputs said segments to a plurality of output ports of said station on the basis
5 of said message identification data.

Preferably said at least one switching station includes stored routing data which maps said message identification data to said plurality of output ports, and said segments received by said station which include said message identification are
10 outputted on said output ports in accordance with said routing data.

Preferably said method includes generating and transmitting a plurality of beginning segments which include respective destination addresses and said message identification data, and establishing said routing data on the basis of said beginning
15 segments as said beginning segments are respectively routed through said switching station to respective ones of said output ports on the basis of said destination addresses.

The present invention provides a multicasting method for a telecommunications
20 network which is adapted to transmit information in segments of data, said method comprising:

generating and transmitting a plurality of beginning segments for and to desired destinations of said information, said beginning segments including respective destination addresses, common message identification data and a common part of said
25 information;

establishing routes through said network to said destinations on the basis of said message identification data; and

transmitting the remainder of said information on at least one remainder segment which includes said message identification data, said remainder segment
30 being routed through said network to said destinations on the basis of said message identification data.

- 3 -

Preferably said beginning segments establish said routes as they are transmitted through said network.

Preferably the remainder of said information is transmitted on a plurality of 5 continuation segments and an end segment, which each include a respective part of said information.

The present invention also provides a multicasting method for a telecommunications network which is adapted to transmit a datagram in segments of 10 data, said segments including a beginning segment, at least one continuation segment and an end segment, each including a respective part of the information to be transmitted by said datagram and common message identification data, said method comprising:

replicating said beginning segment to generate a plurality of beginning 15 segments which include said message identification data, a common part of said information, and different destination addresses,

transmitting said plurality of beginning segments through said network on the basis of said destination addresses to respective destinations corresponding thereto and establishing routing data at switching stations of said network which maps said 20 message identification data to output ports of said stations, and

transmitting said at least one continuation segment and said end segment through said network to said destinations on the basis of the message identification data included therein and said routing data.

25 The present invention further provides a switching station for a telecommunications network which is adapted to transmit information in segments of data, beginning segments being used to transmit part of said information and including respective destination addresses and common message identification data when said information is to be multicast, the remainder of said information being transmitted on 30 at least one remainder segment which includes said message identification data, said station comprising an input port for receiving said segments, a plurality of output

- 4 -

ports, and means for processing and transmitting said beginning segments to respective ones of said output ports on the basis of said destination addresses and establishing and storing routing data therein on the basis of said message identification data, and for transmitting said at least one remainder segment, on being received by said switch,

5 on the basis of said message identification data to all of the output ports which received said beginning segments.

Preferably said routing data is stored as a routing table which maps message identification data to output ports after said beginning segments have been received
10 and processed.

The method and station described above are particularly advantageous for use in networks which employ the DQDB (Distributed Queue Dual Bus) protocol which is described in the report of the IEEE 802.6 Working Group Entitled "Proposed IEEE
15 Standard 802.6 - Distributed Queue Dual Bus (DQDB) Metropolitan Area Network (MAN)", Draft D10, May 1989 and the specification of International Application PCT/AU85/00304 (International Publication WO 86/03639) which are herein incorporated by reference. The method and station are, however, suitable for use in any network which is able to employ segmented datagrams, or packets. The method
20 uses bandwidth efficiently and does not require additional routing information. The approach adopted by the multicasting method described above is less expensive to implement than the replication method for any number of destinations. The broadcast method is also more expensive to implement than the method of the present invention and the costs only become comparable for large numbers of destinations.
25

Preferred embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings wherein:

Figure 1 is a diagram of the format of a datagram;
Figure 2 is a diagram of a segmented datagram;
30 Figure 3 is a diagram of the format of a segment of a datagram;
Figure 4 is a diagram of a preferred multicasting arrangement in a network;

- 5 -

Figure 5 is a diagram of a datagram which has been segmented according to the method of the present invention;

Figure 6 is a diagram of a preferred embodiment of a switch, or station, according to the present invention; and

5 Figure 7 is a diagram illustrating use of the method of the present invention in a network which employs the DQDB protocol.

According to the standard which has been adopted by the IEEE 802.6 Working Group, a connectionless packet, or datagram 10, as illustrated in Figure 1, includes a
10 number of fields 12 which are designated for containing specific data. The header 14 of the datagram includes transmission information such as a destination address 16 and a source address 18. In segmenting telecommunications networks, a datagram 10, as shown in Figure 2, is segmented into a number of segments 20, 22 and 24. The segments include a beginning of message (BOM) segment 20, a plurality of
15 continuation of message (COM) segments 22 and an end of message (EOM) segment 24. The segments 20, 22 and 24 each include a 5 octet header 26 and a payload field 28 of 48 octets, as shown in Figure 3, which includes part of the information which is to be transmitted by the datagram. The segments 20, 22 and 24 further include a segment type field 30, which indicates whether the segment is a BOM, COM or EOM
20 segment, and a message identifier (MID) field 32. The BOM, COM and EOM segments 20, 22 and 24 of a datagram 10 are identified as belonging to the datagram 10 by including a common message identifier in their respective MID fields 32. The segments 20, 22 and 24 are each used to transmit a respective part of the information to be transmitted by the datagram 10.

25

To perform efficient multicasting over a large network, distribution or "splitting" of the information to be multicast should be carried out by each station along the routes to the desired destinations. For example, in a network 34, as shown in Figure 4, where information from a source terminal 36 is to be multicast to three
30 groups of destinations 38, the information is first split at a station, or switch, 40 to three output lines for each group. The information is transmitted via the output lines

- 6 -

to respective stations or switches 42 of each group. The stations 42 further split the information received so as to transmit the information to the desired destinations 38 connected thereto.

5 The present invention has been developed with the above principle in mind and preferred embodiments of the method and station of the present invention are hereinafter described.

A multicasting method according to the present invention involves replicating
10 the BOM segment of a datagram 10 to be multicast, as shown in Figure 5, into a plurality of BOM segments 50, 52, 54 and 56, one for each destination of the information, before transmitting the datagram. The segments 50, 52, 54 and 56 each include a respective unicast destination address (UDA) and would not be distinguishable from a unicast BOM segment 20, except the replicated BOM segments
15 50 each include the same MID. The COM and EOM segments 22 and 24 of the datagram 10 remain the same and are not replicated for each destination. A datagram 10 to be multicast has a multicast destination address (MDA).

The datagram 10 is transmitted and multicast by the stations, or switches, 60
20 of the network, as shown in Figure 6. Four switch structures which could be employed to implement the stations 60 are described in a paper by Andrew R Jacob entitled "A Survey of Fast Packet Switches", Computer Communications Review, Vol 20 No 1 January 1990, herein incorporated by reference. The stations 60 each include processing circuitry and data storage circuitry and on receiving the plurality of BOM
25 segments 50, 52, 54 and 56 on an input line 62 process the destination addresses in the segments 50, 52, 54 and 56. A station 60 directs the BOM segments 50, 52, 54 and 56 to the appropriate output port 64, 66, 68, 70 or 72 of the station 60 depending on the destination indicated by the destination address of each segment. For instance, in the example illustrated in Figure 6, the first BOM segment 50 is outputted on the
30 fifth output port 72, the third BOM segment 54 is outputted on the first output port 64 and the second and fourth BOM segments 52 and 56 are outputted on the second

- 7 -

output port 66.

The station 60 in processing the BOM segments 50, 52, 54 and 56 extracts the MID from each segment and establishes and stores routing information which maps
5 the MID to the output port to which the respective BOM segment has been transmitted. The routing information is stored in the data storage circuitry of the switch 60 as a routing table.

As the BOM segments 50, 52, 54 and 56 all have the same MID, the routing
10 table maps the MID to each of the output ports which received the BOM segments 50, 52, 54 and 56. COM and EOM segments 20, 22 and 24 which are received thereafter by the stations 60 are routed to respective output ports 64, 66, 68, 70 or 72 on the basis of the MID contained in the segments 22 and 24. Hence, if an MID is mapped, or allocated, to more than one output port of a station 60, COM and EOM segments
15 22 and 24 received by the station 60 and which include the MID are multicast to each one of the allocated output ports. The method thereby effectively employs the principle described previously with reference to Figure 4.

With reference to the example illustrated in Figure 6, the remainder of the
20 information of the datagram 10 not included in each BOM segment 50, 52, 54 and 56 is transmitted in a COM segment 22 and an EOM segment 24. On the basis of the routing table established after processing of the BOM segments 50, 52, 54 and 56, the segments 22 and 24 are transmitted to the first port 64, the second port 66 and the fifth port 72. The segments 22 and 24 transmitted to the output port 66 will be
25 multicast again at a later stage by another station 60 when the second and fourth BOM segments 52 and 56 are transmitted to different output ports.

The routing tables in the station 60 of the network may be established, as described previously, when the BOM segments are processed or the tables may be
30 established by a network managing circuit when the BOM segments are replicated, as shown in Figure 5.

- 8 -

The multicasting method described above is suitable for implementation in a QPSX network 100 which employs the DQDB protocol. An example is illustrated in Figure 7 where a first datagram including segments having an MID 1 is multicast to two stations 102 and 104 from a sending station 106. A second datagram including segments having an MID 2 is transmitted to the second receiving station 104 and a third datagram including segments having an MID 3 is transmitted to the first receiving station 102 by the sending station 106. The sending station 106 is placed between the two receiving stations 102 and 104 and each station is connected to the two buses 108 and 110, which transmit slots, or segments, in opposite directions.

10

When segments of a datagram are to be transmitted by the sending station 106, a routing table 112 is updated, on the basis of the destination address of the datagram to map the MID of the segments of the datagram to a desired bus 108 or 110 for transmission. In the case of the first datagram, the MID 1 is mapped to both buses 15 108 and 110, for the second datagram the MID 2 is mapped to the first bus 108 and for the third datagram the MID 3 is mapped to the second bus 110. The BOM segment of the first datagram is replicated and the replicated segments include respective destination addresses and are placed on the corresponding bus 108 or 110.

20 On receiving BOM segments, the receiving stations 102 and 104 process the unicast destination address included in the BOM segments and update respective receiving tables 114 and 116 which map the MID's of the segments to a receive flag. The receive flag determines whether the receiving station 102 or 104 is to receive or accept segments with the corresponding MID. Therefore, the routing table 114 for the 25 first receiving station 102 has receive flags set to "yes" for only MID's 1 and 3 and the routing table 116 of the second receiving 104 has receive flags set to "yes" for the MID's 1 and 2 only. With routing tables 112, 114 and 116 established as shown in Figure 7, segments with the MID 1 are placed on both buses 108 and 110 and multicast to both receiving stations 102 and 104, whereas segments with MID's 2 and 0 3 are transmitted and received by the third and second receiving stations 104 and 102, respectively.

- 9 -

Existing segmenting telecommunications networks can be, in most cases, reconfigured to perform the multicasting method of the present invention by altering the software in the switching stations so as to produce and handle the replicated BOM segments and establish and use the necessary routing tables for the remaining 5 segments.

- 10 -

CLAIMS:

1. A multicasting method for a telecommunications network which is adapted to transmit information in segments (20, 22, 24) of data (10), said method comprising:
 - 5 generating and transmitting segments (22, 24) of data (10) to be multicast, said segments including common message identification data (32); routing said segments (22, 24) through said network using at least one switching station (60) which outputs said segments (22, 24) to a plurality of output ports (64, 66, 72) of said station (60) on the basis of said message identification data
 - 10 (32).
2. A multicasting method as claimed in claim 1, wherein said at least one switching station (60) includes stored routing data which maps said message identification data to said plurality of output ports (64, 66, 72), and said segments (22, 24) received by said station (60) which include said message identification data are outputted on said output ports (64, 66, 72) in accordance with said routing data.
3. A multicasting method as claimed in claim 2, including generating and transmitting a plurality of beginning segments (50, 52, 54, 56) which include respective destination addresses and said message identification data (32), and establishing said routing data on the basis of said beginning segments (50, 52, 54, 56) as said beginning segments (50, 52, 54, 56) are respectively routed through said switching station (60) to respective ones of said output ports (64, 66, 72) on the basis of said destination addresses.
- 25 4. A multicasting method for a telecommunications network which is adapted to transmit information in segments (20, 22, 24) of data (10), said method comprising:
 - generating and transmitting a plurality of beginning segments (50, 52, 54, 56) for and to desired destinations of said information, said beginning segments including
 - 30 respective destination addresses, common message identification data (32) and a common part of said information;

- 11 -

establishing routes through said network to said destinations on the basis of said message identification data (32); and

transmitting the remainder of said information on at least one remainder segment (22, 24) which includes said message identification data (32), said remainder segment being routed through said network to said destinations on the basis of said message identification data (32).

5. A multicasting method as claimed in claim 4, wherein said beginning segments (50, 52, 54, 56) establish said routes as they are transmitted through said network.

10

6. A multicasting method as claimed in claim 5, wherein said routes are established by establishing routing data in switching stations (60) of said network as said beginning segments (50, 52, 54, 56) are routed through said stations (60) on the basis of said destination addresses, and said routing data maps message identification data (32) of incoming segments to the output ports (64, 66, 72) of said stations (60).

15

7. A multicasting method as claimed in claim 5 or 6, wherein the remainder of said information is transmitted on a plurality of continuation segments (22) and an end segment (24), which each include a respective part of said information.

20

8. A multicasting method for a telecommunications network which is adapted to transmit a datagram (10) in segments (20, 22, 24) of data, said segments (20, 22, 24) including a beginning segment (20), at least one continuation segment (22) and an end segment (24), each including a respective part of the information to be transmitted by said datagram (10) and common message identification data (32), said method comprising:

replicating said beginning segment (20) to generate a plurality of beginning segments (50, 52, 54, 56) which include said message identification data (32), a common part of said information, and different destination addresses,

25

transmitting said plurality of beginning segments through said network on the basis of said destination addresses to respective destinations corresponding thereto and

30

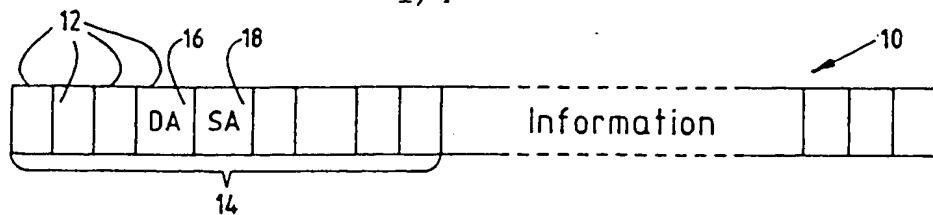
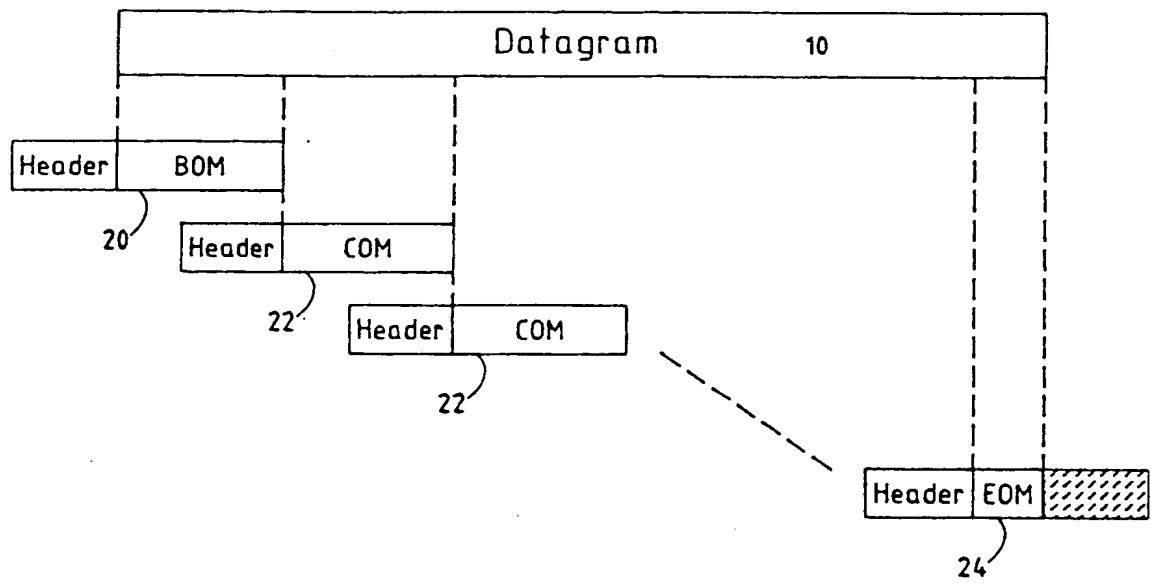
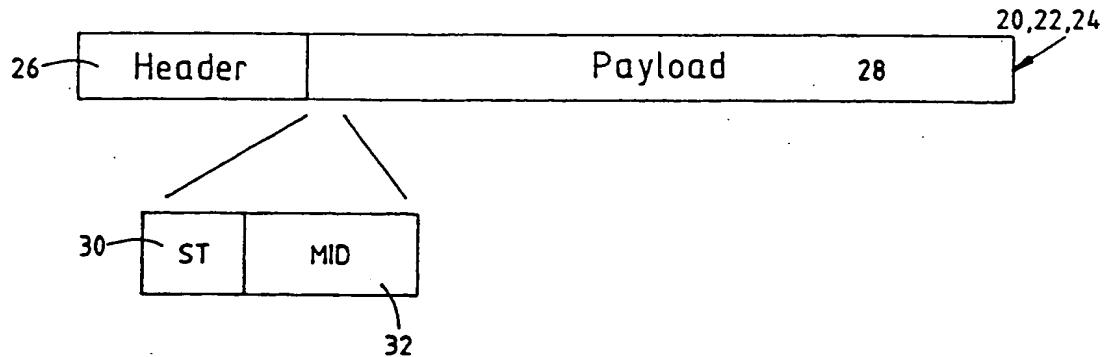
- 12 -

establishing routing data at switching stations (60) of said network which maps said message identification data (32) to output ports (64, 66, 72) of said stations (60), and transmitting said at least one continuation segment (22) and said end segment (24) through said network to said destinations on the basis of the message 5 identification data (32) included therein and said routing data.

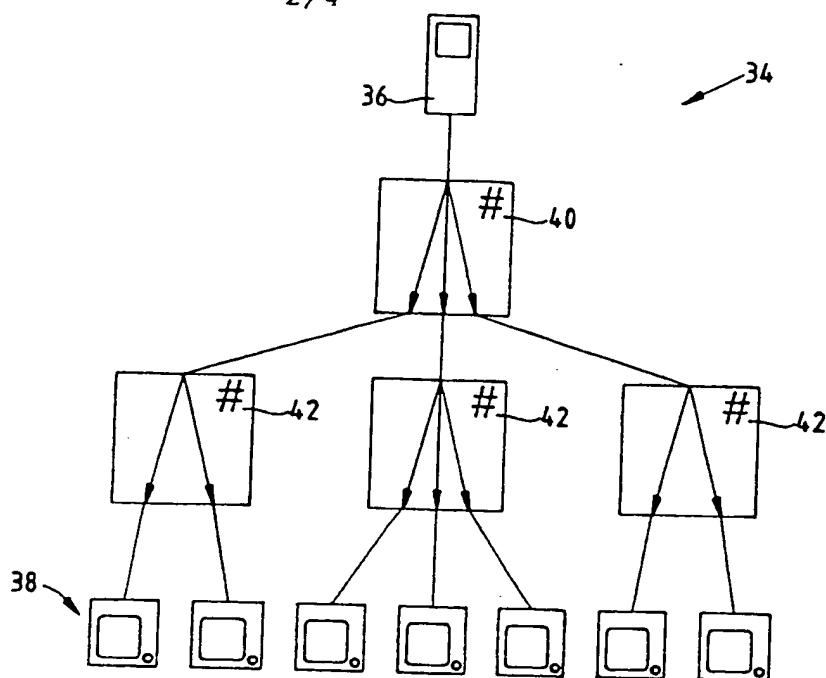
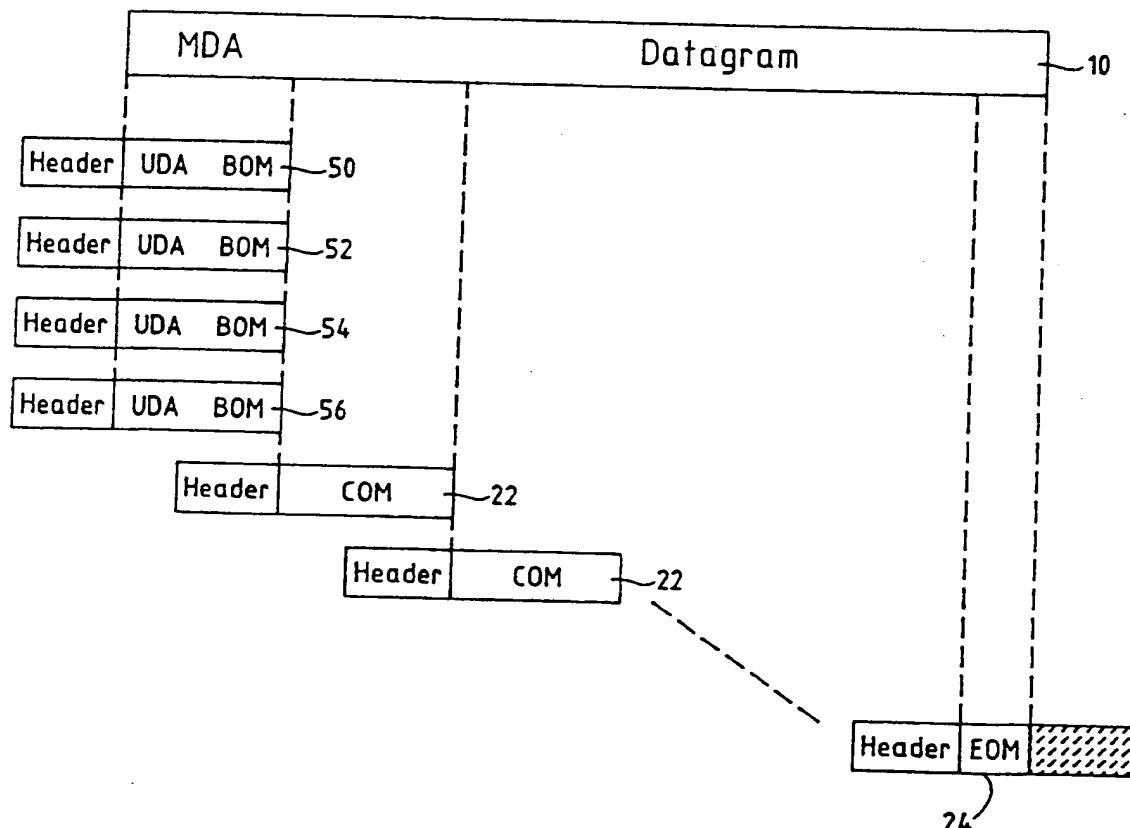
9. A switching station (60) for a telecommunications network which is adapted to transmit information in segments (20, 22, 24) of data, beginning segments (50, 52, 54, 56) being used to transmit part of said information and including respective 10 destination addresses and common message identification data (32) when said information is to be multicast, the remainder of said information being transmitted on at least one remainder segment (22, 24) which includes said message identification data (32), said station (60) comprising an input port (62) for receiving said segments, a plurality of output ports (64, 66, 68, 70, 72), and means for processing and 15 transmitting said beginning segments (50, 52, 54, 56) to respective ones (64, 66, 72) of said output ports (64, 66, 68, 70, 72) on the basis of said destination addresses and establishing and storing routing data therein on the basis of said message identification data (32), and for transmitting said at least one remainder segment (22, 24), on being received by said switch (60), on the basis of said message identification data (32) to 20 all of the output ports (64, 66, 72) which received said beginning segments (50, 52, 54, 56).

10. A switching station as claimed in claim 9, wherein said routing data is stored as a routing table (112) which maps message identification data (32) to output ports 25 (64, 66, 72) after said beginning segments (50, 52, 54, 56) have been received and processed.

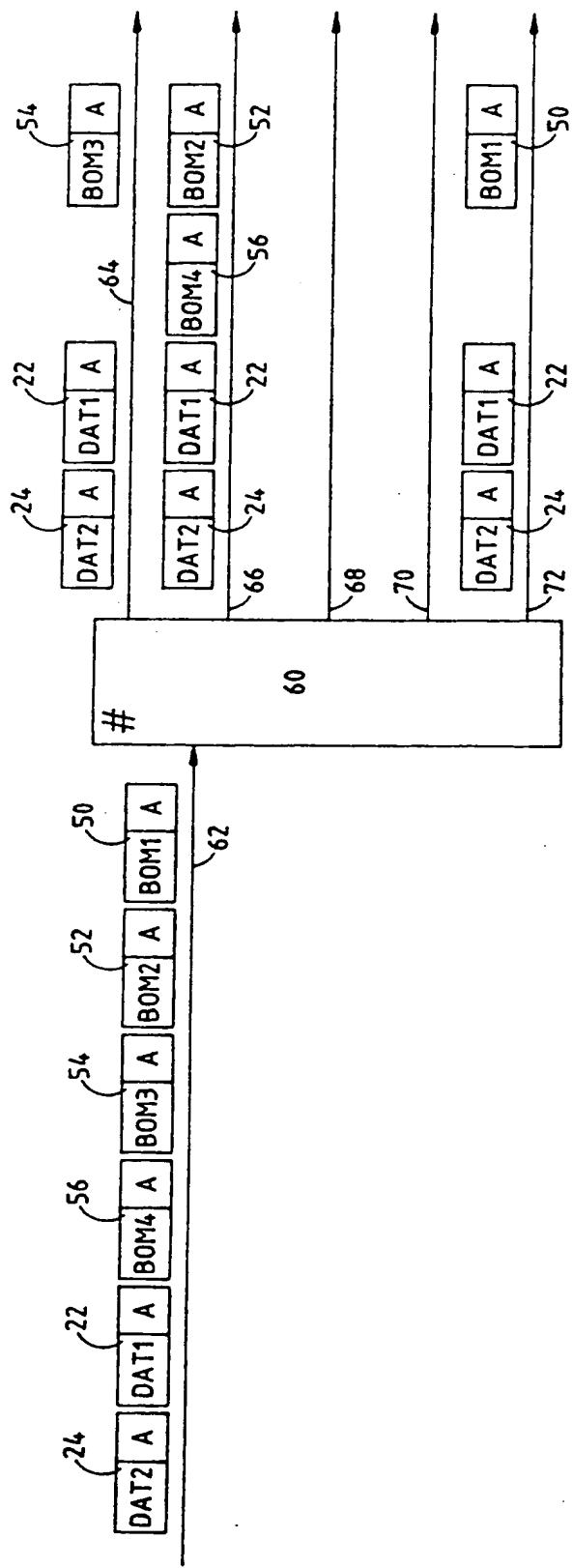
1/4

FIG 1FIG 2FIG 3

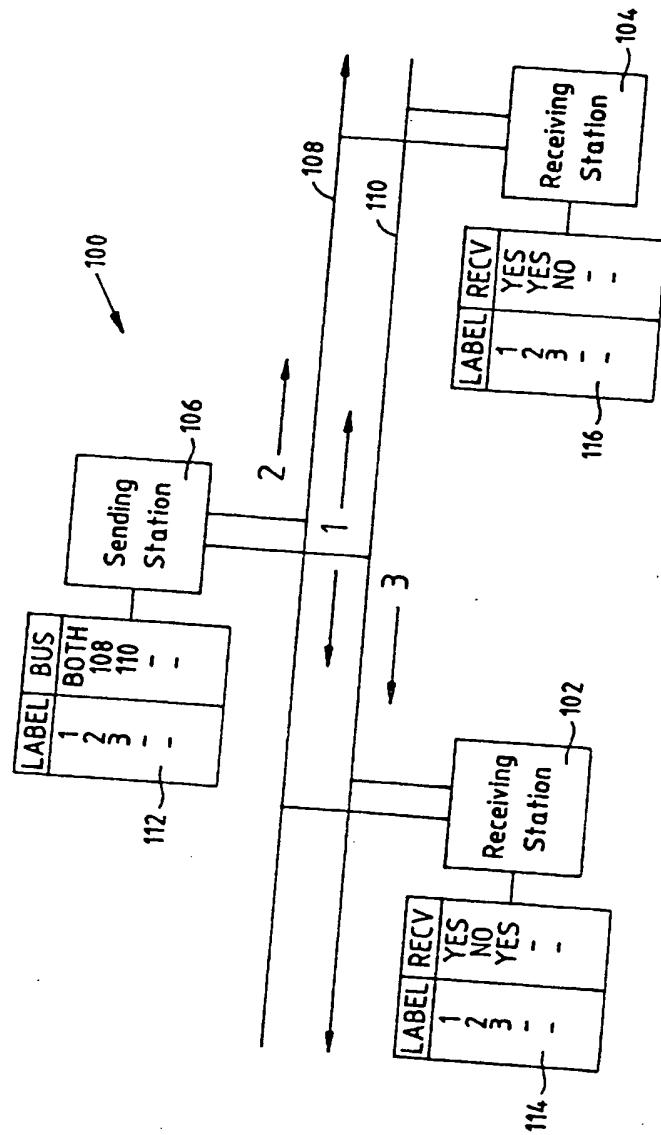
2/4

FIG 4FIG 5

3/4

FIG 6

4/4

FIG 7

INTERNATIONAL SEARCH REPORT

International Application No. PCT/AU 91/00111

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) 6

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl.⁵ H04L 12/56; H04L 12/18

II. FIELDS SEARCHED

Minimum Documentation Searched 7

Classification System 1	Classification Symbols
IPC	H04L 11/18, 11/20, 12/18, 12/56

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in the Fields Searched 8

AU : IPC as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT 9

Category*	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages 12	Relevant to Claim No 13
P,X	WO,A, 90/05419 (BUDRIKIS et al) 17 May 1990 (17.05.90) See page 2 line 25 - page 5 line 36.	(1)
Y	AU,A, 12628/88 (ALCATEL N.V.) 22 September 1988 (22.09.88) See claim 1.	(1)
Y	AU,A, 26685/88 (ALCATEL N.V.) 22 June 1989 (22.06.89) See page 3 line 26 - page 4 line 14.	(1)
Y	AU,A, 26526/88 (ALCATEL N.V.) 22 June 1989 (22.06.89) See page 2 line 21 - page 3 line 13.	(1)
Y	WO,A, 88/07293 (CANTONI et al) 22 September 1988 (22.09.88) See page 5 lines 3-15.	(1)

(continued)

* Special categories of cited documents: 10

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search
3 June 1991 (03.06.91)

Date of Mailing of this International Search Report

7 June 1991

International Searching Authority

Signature of Authorized Officer

Australian Patent Office

a. W. Duke
A.W. DUKE

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

Y	AU,A, 66861/86 (INTERNATIONAL STANDARD ELECTRIC CORPORATION) See page 2 lines 18-29.	(1)
Y	US,A, 4577308 (LARSON et al) 18 March 1986 (18.03.86) See column 11 lines 25-33.	(1)
Y	US,A, 4603416 (SERVEL et al) 29 July 1986 (29.07.86) See abstract.	(1)
Y	WO,A, 86/02512 (HUGHES AIRCRAFT COMPANY) 24 April 1986 (24.04.86) See page 3 line 34 - page 4 line 14.	(1)
Y	WO,A, 87/00372 (AMERICAN TELEPHONE & TELEGRAPH COMPANY) 15 January 1987 (15.01.87) See page 3 lines 16-24.	(1)

V. [] OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE 1

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. [] Claim numbers ..., because they relate to subject matter not required to be searched by this Authority, namely:

2. [] Claim numbers .., because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. [] Claim numbers ..., because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4 (a):

VI. [] OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING 2

This International Searching Authority found multiple inventions in this international application as follows:

1. [] As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. [] As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. [] No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. [] As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

| Remark on Protest

| [] The additional search fees were accompanied by applicant's protest.
| [] No protest accompanied the payment of additional search fees.

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON
INTERNATIONAL APPLICATION NO. PCT/AU 91/00111

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document
Cited in Search
Report

Patent Family Members

WO 9005419

AU 46218/89

CA 2002729

AU 12628/88

BE 1000396
WO 8807298

EP 357618

ES 2006601

AU 26685/88

CN 1010539
JP 2004054

DE 3742939
NO 885542

EP 320772
US 4926416

AU 26526/88

CN 1034648
EP 320714
US 4922487

CN 1009411
JP 2002767

DE 3742941
NO 885544

WO 8807293

AU 14999/88
WO 8807293

EP 308449
EP 308449

JP 1502792

AU 66861/86

BE 904100
EP 231967
JP 1501589
WO 8704579

BR 8707537
EP 290459
NO 873612
HU 47771

DK 5019/87
FI 882784
US 4813037
AT 62366

CONTINUED

INTERNATIONAL APPLICATION NO. PCT/AU 91/00111 (CONTINUED)

Patent Document
Cited in Search
Report

Patent Family Members

US 4577308	CA 1237802 JP 61501814	DE US 3572905 4577308	EP WO 174998 8504776
US 4603416	CA 1224556 FR 2538976	DE JP 3366490 59135994	EP 113307
WO 8602512	DE 3576775 JP 62500902	EP KR 198010 9006791	IL US 76532 4630258
WO 8700372	CA 1258113 JP 62503207 JP 62503207	DE US 3677351 4701906	EP WO 226632 8700372

END OF ANNEX